

CLAIMS

What is claimed is:

1. A bearing, comprising:  
  
a first bearing ring including a race;  
  
a second bearing ring including a race that is aligned with the first bearing ring race;  
  
rotating members located between the first and second bearing ring races and bearing thereon;  
  
an alignment cage located between the first and second bearing rings and having openings therein that locate the rotating members in spaced-apart alignment between the first and second bearing races; and  
  
one or more vibration suppressors coupled to the alignment cage.
2. The bearing of claim 1 wherein the alignment cage has at least a first face outboard of the rolling members and the one or more vibration suppressors are mounted at least in part on the first face.
3. The bearing of claim 1 wherein the alignment cage has opposed first and second faces between which the openings extend and at least a third face coupling the first and second faces and wherein at least one of the one or more vibration suppressors is attached to the third face.
4. The bearing of claim 1 wherein the alignment cage is substantially circular with opposed first and second faces between which the openings extend and at least a third face coupling the first and second faces and wherein at least one of the one or more vibration suppressors is mounted in the third face.

5. The bearing of claim 1 wherein the alignment cage has first and second faces between which the openings extend and at least a third face coupling the first and second faces and wherein at least one of the one or more vibration suppressors comprises one or more arc segments coupled to the third face by one or more springs.

6. The bearing of claim 5 further comprising one or more vibration damping pads between the third face and the one or more arc segments.

7. The bearing of claim 1 wherein some of the one or more vibration suppressors comprise one or more substantially discrete masses coupled to the alignment cage by one or more springs.

8. The bearing of claim 1 wherein the one or more vibration suppressors comprise one or more tuned mass dampers mounted within or on the alignment cage.

9. The bearing of claim 8 wherein the alignment cage comprises a circumferential wall pierced by the openings and at least one of the one or more tuned mass dampers is mounted within the circumferential wall.

10. A method for providing bearings having reduced vibrations, comprising:  
determining resonant frequencies of an unaltered bearing alignment cage;

selecting spring-mass combinations tuned to, at least in part, anti-resonate the resonant frequencies of the unaltered bearing cage

coupling the tuned spring-mass combinations to the unaltered bearing cage to form a modified bearing cage;

providing first and second bearing rings including races, and rolling members adapted to bear on the races; and

assembling the first and second opposed races, the rolling members and the modified bearing cage such that the rolling members are held in spaced-apart alignment between the first and second opposed races by the modified cage with the rolling members bearing on the opposed races.

11. The method of claim 10 wherein the coupling steps comprises:

attaching at least one end of a spring of the spring-mass combination to the unaltered cage and attaching a distal end of the spring to the mass, which is then freely suspended, by the spring.

12. The method of claim 10 wherein the selecting step comprises:

selecting spring-mass combinations having predetermined vibrational modes;

and the coupling step comprises,

attaching the spring-mass combinations to the cage oriented so that the vibrational modes of the spring-mass combinations match the cage vibrational modes desired to be attenuated.

13. The method of claim 10 wherein the coupling step further comprises providing damping means in parallel to the spring-mass combinations.

14. A bearing comprising:
- first and second bearing rings including races;
- rotating members rollingly engaging both first and second bearing races;
- a cage for aligning the rotating members between the first and second bearing races; and
- vibration reduction means coupled to the cage.
15. The bearing of claim 14 wherein the vibration reduction means comprises one or more resonant spring-mass combinations attached to the cage.
16. The bearing of claim 15 further comprising damping means coupled to the resonant spring-mass combinations.
17. The bearing of claim 15 wherein the spring-mass combination comprises a spring coupled to a substantially discrete mass.
18. The bearing of claim 15 wherein the spring-mass combination comprises one or more springs coupled to a distributed mass.